

# Linux with Upstream Kernel On Snapdragon® X Elite Compute Platform

**Rajendra Nayak**

Principal Engineer, Qualcomm India Private Limited



Next Gen Laptop SoC



Snapdragon X Elite Linux support



Demo

Circa - 2018 to 2023



## Lenovo Yoga C630

Snapdragon 850

## Lenovo Flex 5G

Snapdragon 8cx Gen1

## Lenovo Thinkpad X13s

Snapdragon 8cx Gen3

[AArch64 Laptops · GitHub](#)

# 2024 - Qualcomm Oryon™ CPUs

- CPU
  - Oryon - 12 cores
  - Up to 3.8 GHz
  - Single core and Dual core boost upto 4.3GHz
- Qualcomm® Adreno™ GPU
  - Up to 4.6 TFLOPs
- NPU
  - 45 TOPs
- Memory
  - LPDDR5x, transfer rate 8533 MT/s
  - 16-bit, 8 Channel, Up to 64 GB
- Storage
  - SDv3.0/NVMe SSD over PCIe Gen4/UFS
- Display
  - DP/eDP
- Video
  - encode 4K60 - H.264, HEVC, AV1
  - Decode 4K120 - H.264, HEVC, VP9, AV1
- Camera ISP
- Qualcomm Aqstic™ audio codec
- Cellular Modem RF
- WiFi/Bluetooth

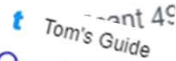


# Snapdragon X Elite Performance Benchmarks



Snapdragon X Elite shows a big improvement in latest benchmark

Latest benchmark tests show Snapdragon X Elite processor



Qualcomm says Snapdragon X Elite blows away Apple chip with 28% faster performance

So far, we've heard about how fast the Snapdragon X Elite is starting to see just how fast it is.



Playing PC games on a Snapdragon believer

I played two PC games on a reference laptop with the Snapdragon X Elite and came away with my mind blown.



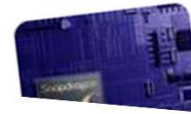
The Snapdragon X Elite is Real - Thurrott.com

I want to believe. But now I have the hands-on experience I need to cast aside (most of) the doubt: The Qualcomm Snapdragon X Elite is the...



Qualcomm's Snapdragon X Elite dares to game, reaching 30 FPS in Baldur's Gate 3

Qualcomm's Snapdragon X Elite has some gaming and graphics prowess as seen in a demo where a reference laptop was shown to be running...



# Early Mainline Posts

## Snapdragon 8 Gen 1

- Public announcement: 29<sup>th</sup> Nov '21
- Initial Linux kernel support patchset posted: 1st Dec '21

## Snapdragon 8 Gen 2

- Public announcement: 15<sup>th</sup> Nov '22
- Initial Linux kernel support patchset posted: 16<sup>th</sup> Nov '22

## Snapdragon 8 Gen 3

- Public announcement: 24<sup>th</sup> Oct '23
- Initial Linux kernel support patchset posted: 25<sup>th</sup> Oct '23

## Snapdragon X Elite

- Public announcement: 24<sup>th</sup> Oct '23
- Initial Linux kernel support patchset posted: 25<sup>th</sup> Oct '23

# Boot/UEFI Status

- ✓ UEFI based boot
- ✓ Device tree support
- ✓ Supports standard GRUB/System-d boot
- ✓ DT selection logic is WIP

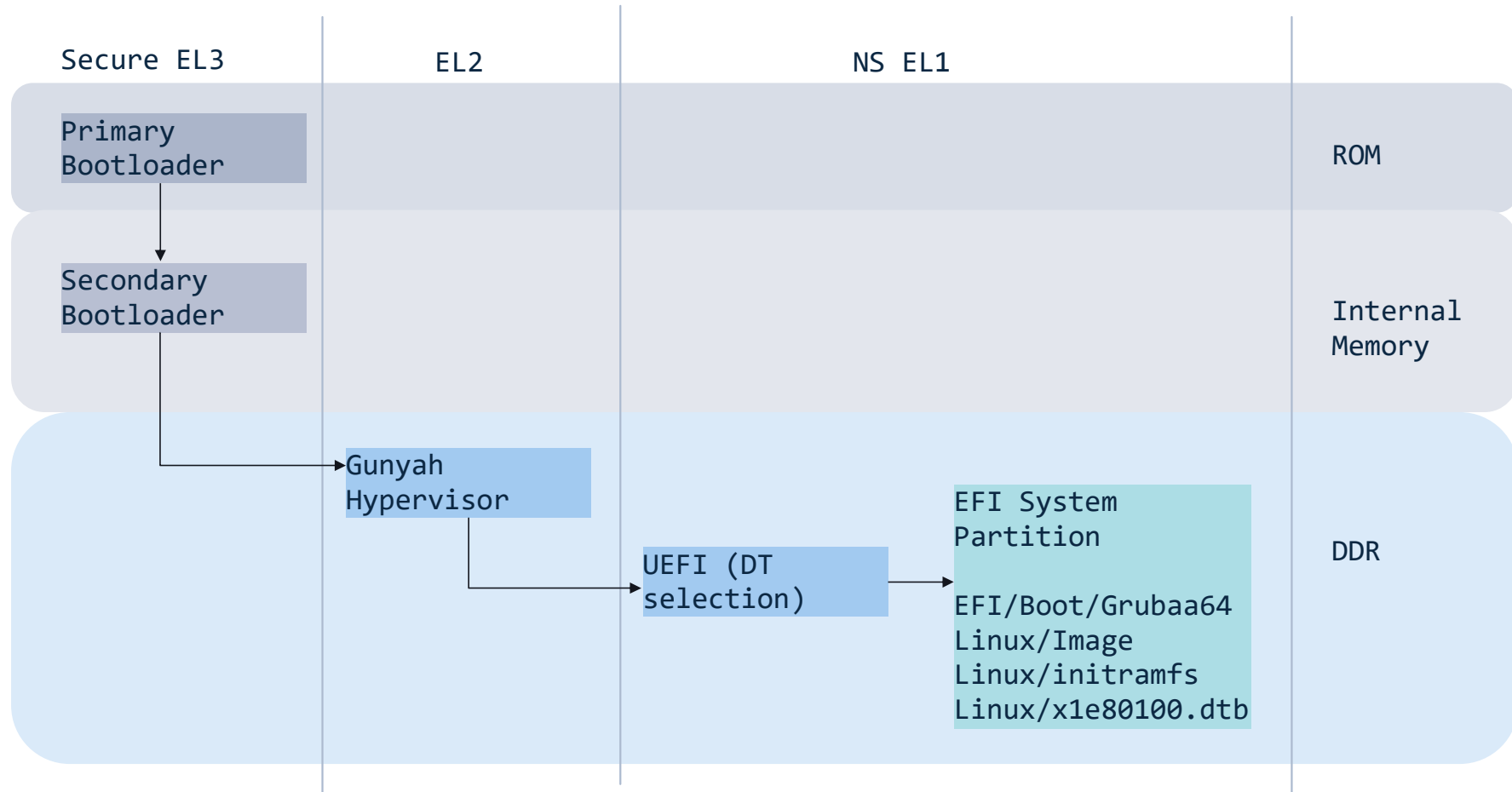
Wednesday, April 17 • 4:55pm - 5:35pm

Shipping Multiple Devicetrees: How to Identify Which DTB Is for My Board? - Elliot Berman, Qualcomm

[Schedule 2024 | LF Events \(linuxfoundation.org\)](#)



# Boot Flow





# Kernel Upstream Status

## Merged (6.7/6.8/6.9 kernels)

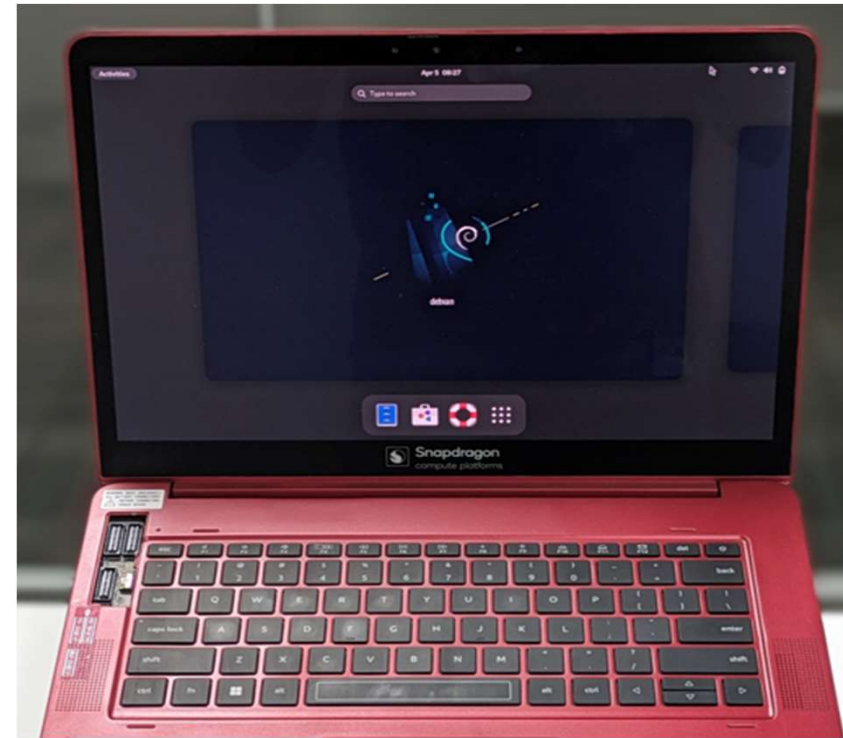
- ✓ Pinctrl (TLMM)
- ✓ Interconnect
- ✓ Clocks (GCC/RPMHCC)
- ✓ Powerdomains (RPMh)
- ✓ SMMU
- ✓ QUP (SPI/I2C/Uart)
- ✓ System Cache
- ✓ PMC8380 PMIC
- ✓ Sound machine driver
- ✓ DWC3
- ✓ Reference Boards (CRD/QCP)
- ✓ ADSP/CDSP support
- ✓ Multimedia Clocks
- ✓ Phy (PCIe/eDP/USB)
- ✓ SSD-NVMe over PCIe



# Kernel Upstream WIP

## Targeted (6.10/6.11 kernels)

- ✓ USB host
- ✓ On Board Display (eDP)
- ✓ GPU
- ✓ Memory DCVS
- ✓ CPUFreq
- ✓ Speakers/MIC/Headset
- ✓ Battery
- ✓ External DP
- ✓ Suspend/Resume
- ✓ Camera
- ✓ Video



# Display Status

- eDP/DP support rework in progress
  - <https://lkml.org/lkml/2024/3/24/258>
  - <https://lkml.org/lkml/2024/3/24/262>
- eDP/DP phy support for X1E SoCs
  - <https://lkml.org/lkml/2024/2/21/15>
- MDSS/DPU support
  - <https://lkml.org/lkml/2024/2/20/1012>
- DP alt-mode support needs a PM8830 retimer driver



# GPU Status

- A740 GPU support already upstream
- A750 GPU patches are on the lists
  - <https://lkml.org/lkml/2024/3/18/350>
- Need incremental changes in kernel and Mesa
  - Firmware push to Linux-firmware WIP



# Video Status

- Updated Video Processing Unit (VPU)
- New Iris Driver posted in July 2023
  - <https://lkml.org/lkml/2023/7/28/802>
- v2 posted extending the existing Venus Driver in Dec 2023
  - <https://lkml.org/lkml/2023/12/20/1164>
- v3 coming soon
- Supports M2M and STREAMING capability
- Supports H264, H265, VP9 decoders
- Supports H264, H265 encoders



# Audio Status

- Soundcard and DMIC support merged
  - <https://lkml.org/lkml/2024/2/12/1109>
- Audio playback via speakers or audio jack headset functional
- DMIC0-3 recording functional
- Multiple Speakers over one soundwire interface merged
- Analog MIC support in progress





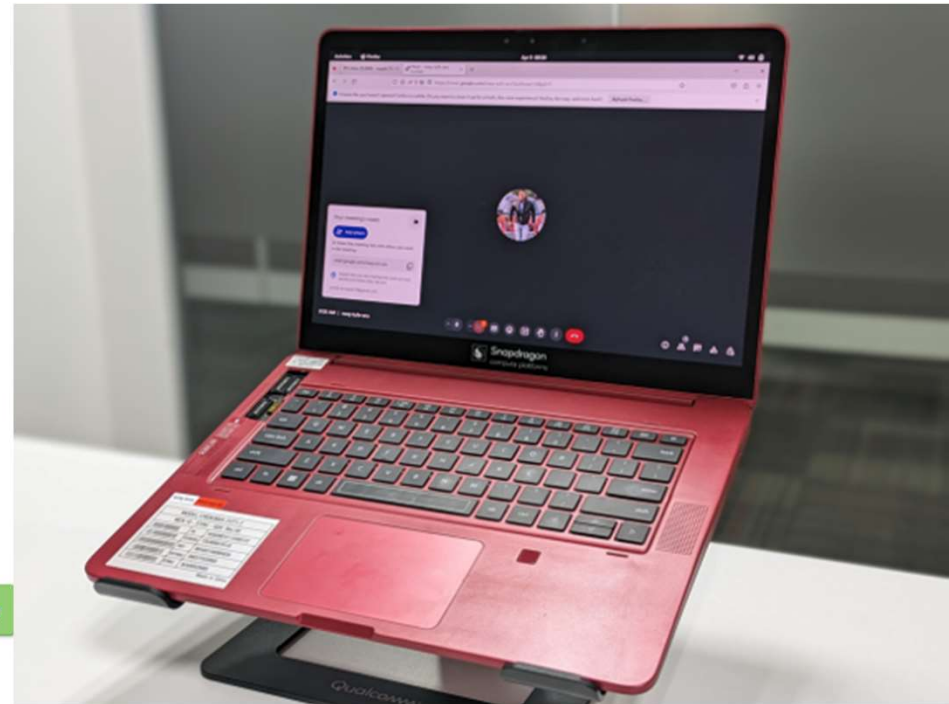
# Camera Status

- CAMCC and other infra support is merged
- Bring up of CSIPHY, CSID, VFE/RDI interfaces in progress
- Libcamera-softisp solution with pipewire enabled firefox should enable using camera with google hangouts/teams or zoom

Wednesday, April 17 • 2:00pm - 2:40pm

Extending Libcamera to Provide a Fully Open Camera SoftISP Stack - Bryan O'Donoghue, Linaro

[Schedule 2024 | LF Events \(linuxfoundation.org\)](#)



# Power Management Status

- Boost frequency and limit notifier support added to the SCMI CPUfreq driver
- CPUFreq including mailbox support
  - <https://lkml.org/lkml/2024/3/28/454>
- SCMI vendor protocol for BUS DCVS proposed
  - <https://lkml.org/lkml/2024/1/17/342>
- S2IDLE supported
  - Some misbehaving drivers need to be fixed
  - Some votes preventing entering lowest power state





# Distro Status

- Experimental installer for the Reference Device
  - <https://git.codelinearo.org/linaro/qcomlt/demos/debian-12-installer-image>



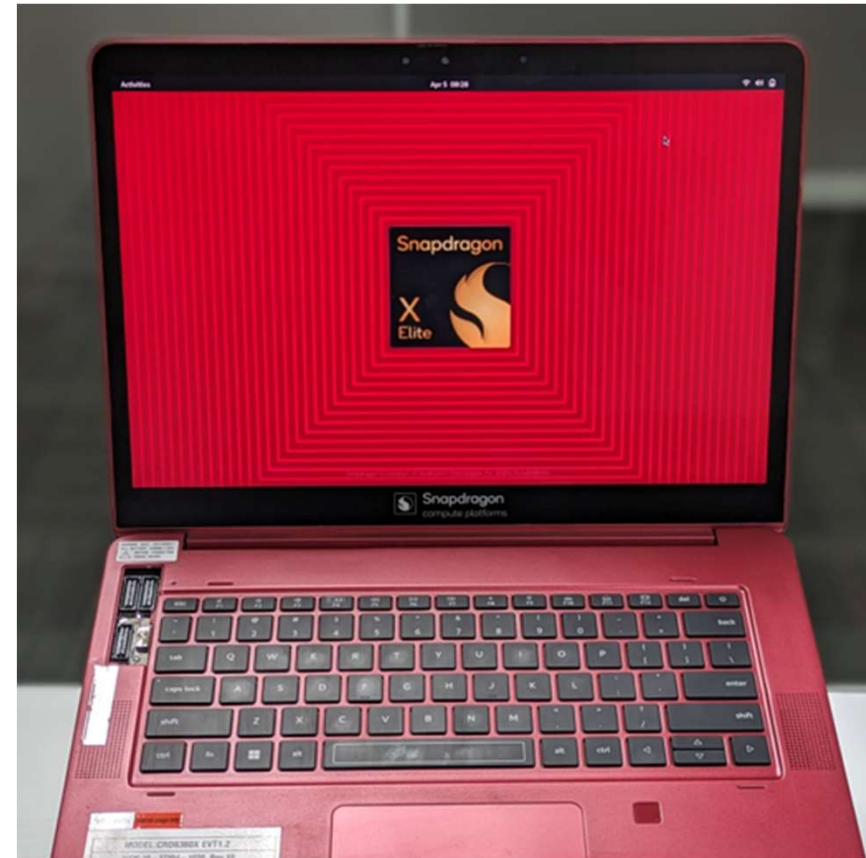
## Roadmap - next few months

- Hardware Video decode with firefox and Chrome
- Enable Camera libcamera-SoftISP solution
- GPU and CPU perf optimizations
- Power optimized (Suspend/DCVS)
- Firmware in Linux-firmware
- Easy installers



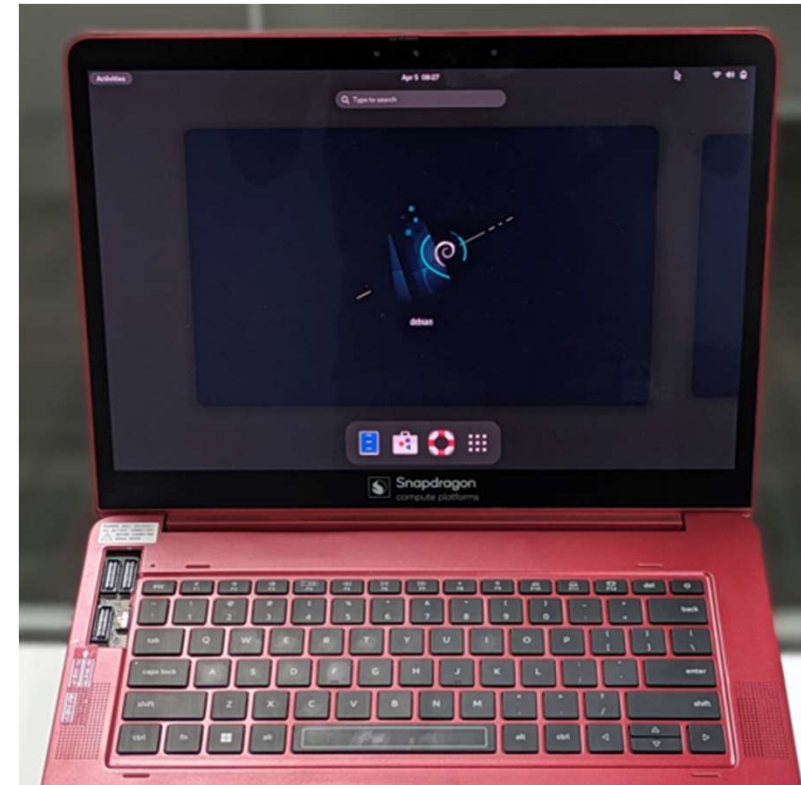
# Demo Hardware Setup

- Display
  - AMOLED 14.5" (2880x1800)
  - 3<sup>rd</sup> Party Touch
- Connectivity - 3x USB-C
- PCIe Gen3 2L
  - WLAN/BT (WCN785x)
  - 5G Modem (SDX65)
- Memory
  - LPDDR5x 16GB
  - SPI NOR Boot
  - SSD-NVMe over PCIe Gen4 4L
- Audio
  - 4x WSA8845
  - WCD9385
  - 4x DMIC



# Demo Software Setup

- Debian 12 SID
- Latest mainline 6.9-rc kernel
  - [https://git.codelinearo.org/abel.vesa/linux/-/tree/x1e80100-next?ref\\_type=heads](https://git.codelinearo.org/abel.vesa/linux/-/tree/x1e80100-next?ref_type=heads)
  - ~ 105 patches
  - ~ 78 already on lists
  - ~ 27 to be posted out
- GPU HW rendering enabled
- Hardware Video decode



# Thank you

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